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Constraints on Mg/Ca-paleothermometry in the western Mediterranean Sea

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In the western Mediterranean Sea, the planktonic foraminifer Globigerina bulloides is abundant and the geochemistry of its test could be used to reconstruct past changes in surface water conditions. Yet, the small, modern sea surface temperature (SST) gradient (∼4°C) in this area does not allow us to develop an accurate calibration of the Mg/Ca thermometer based on G. bulloides specimens picked from surface sediments.
In order to better constrain the incorporation of Mg into foraminiferal tests over a wider temperature range, we generated a high-resolution Mg/Ca record of the surface-dwelling planktonic foraminifera Globigerina bulloides picked from core MD99-2346 collected in the Gulf of Lion and which covers the last 28 000 years. This Mg/Ca record was compared to temperatures generated using modern analogue technique applied to fossil foraminiferal assemblages (SST MAT). The two temperature records display similar patterns during the last 28000 yrs but SST Mg/Ca estimates are several degrees warmer (∼+4°C) than SST MAT. The temperature shift between Mg/Ca temperatures (SST Mg/Ca) and SST MAT remained relatively constant over time. This seems to exclude a bias on Mg/Ca record associated with salinity or secondary Mg-rich calcite encrustation on the foraminiferal tests during early diagenesis. Therefore, anomalously high Mg/Ca suggests either: 1/ the empirical equation for G. bulloides of Elderfield and Ganssen (2000) is incorrect or 2/ there is a specific Mediterranean genotypes of G. bulloides for which a specific Mg/Ca-temperature calibration is needed.